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G01B 5/24

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None

(58) Field of search

G1X

Selected US specifications from IPC sub-class G01B

(54) Square for use in laying out rafter cuts

(57) A roof framing square has a triangular body (2) with an arcuate slot (20) adjacent its hypotenuse side (16) and an arcuate-sided aperture (22) spaced inwardly therefrom. Both arcs (20, 24) are defined by radii having as their centre point a pivot aperture spaced from the first side (10) along the vertical second side (12). A pivot pin seated in the pivot aperture pivotably mounts on the body (2) a protractor arm (4) which is comprised of arm elements disposed on the opposite surfaces of the body. The protractor arm (4) may be secured in a pivoted position by a clamping screw (8). An angular or protractor scale (48) is provided along the arcuate edge (24) of the aperture (22), and two scales (45, 58) which convert the unit rise per unit length data to angular positions are provided along the opposite sides of the arcuate slot (20). The protractor arm (4) is set at the desired angular position, and the square placed upon the board with the appropriate surface of the protractor arm (4) seated firmly thereagainst so that the scribe line may be drawn along the designated side of the square.

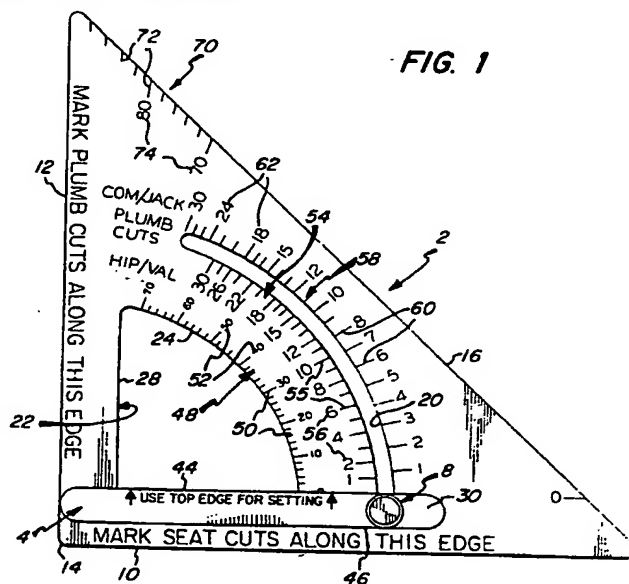


FIG. 1

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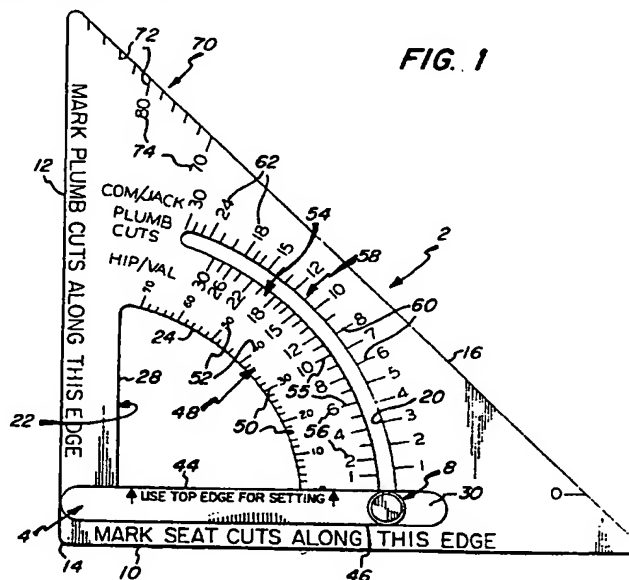
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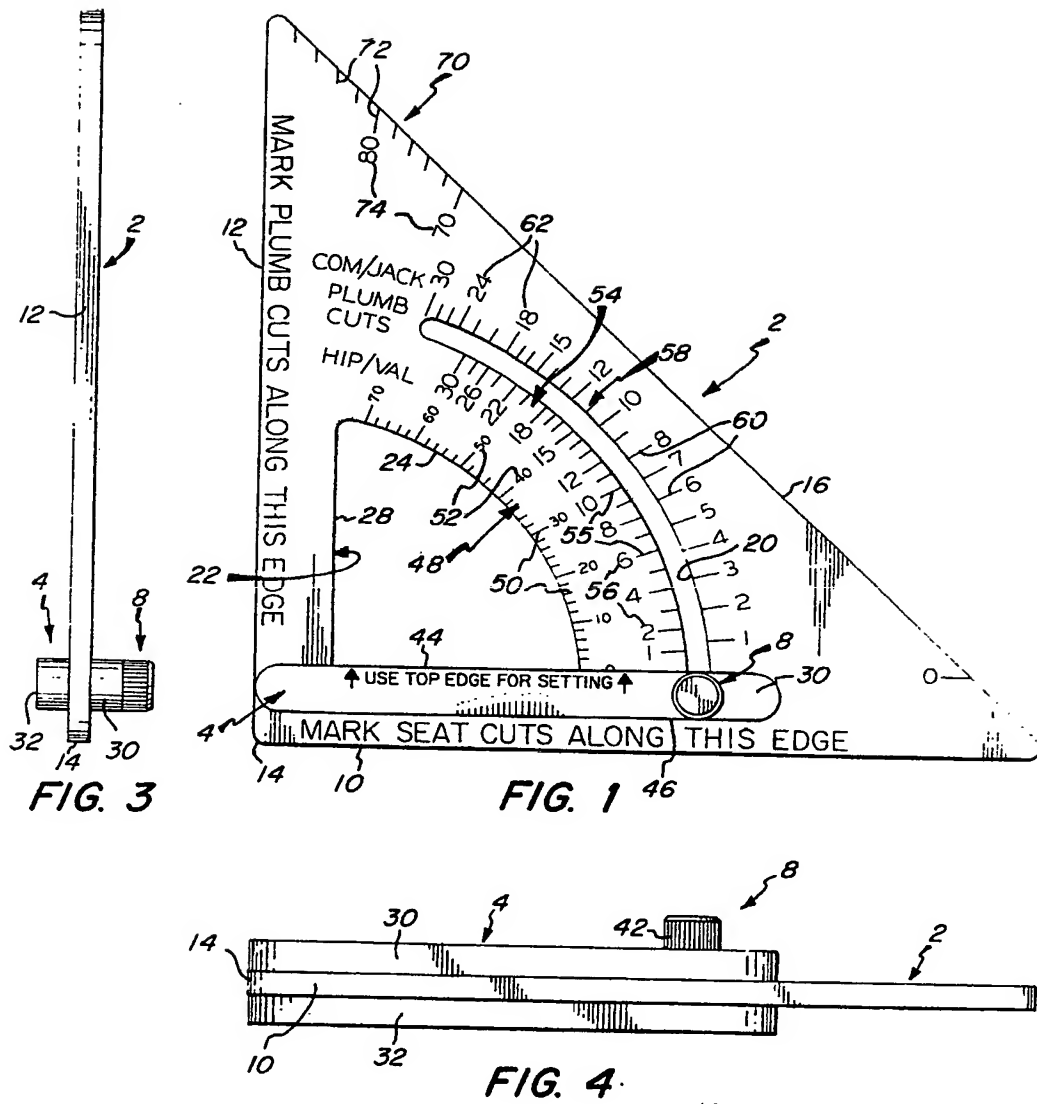
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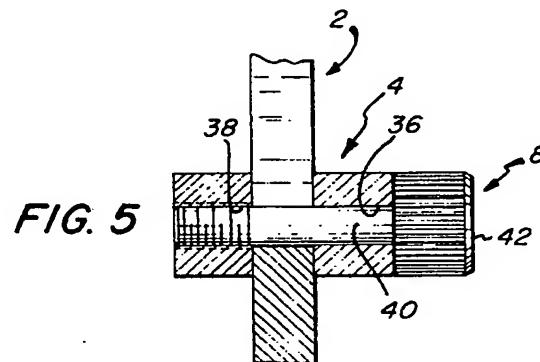
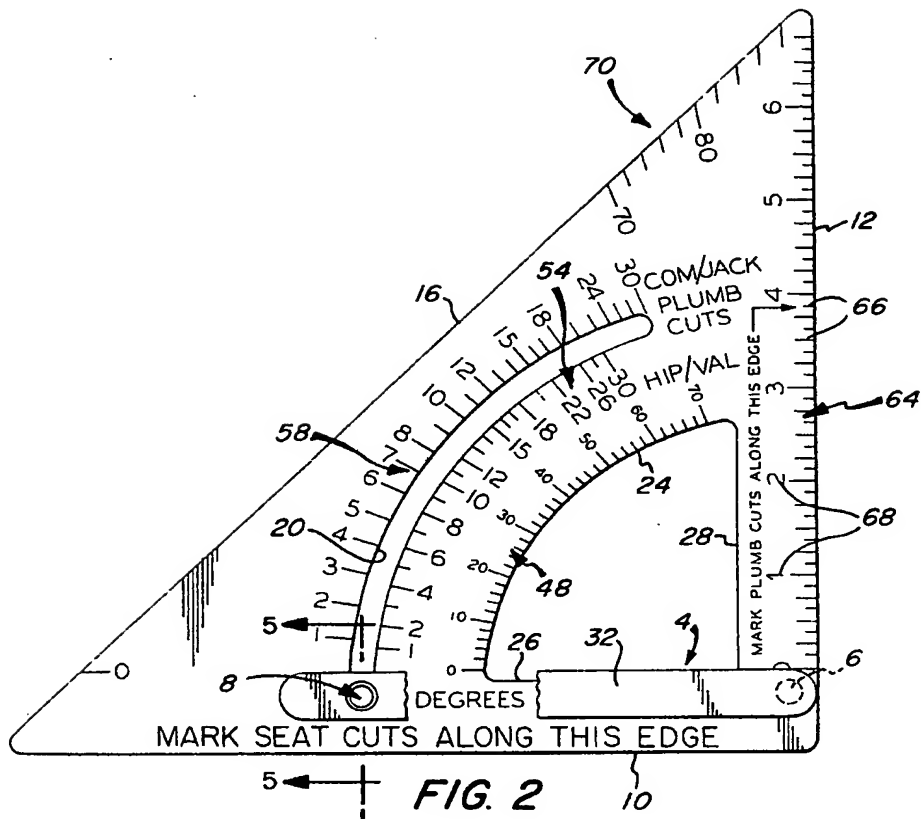
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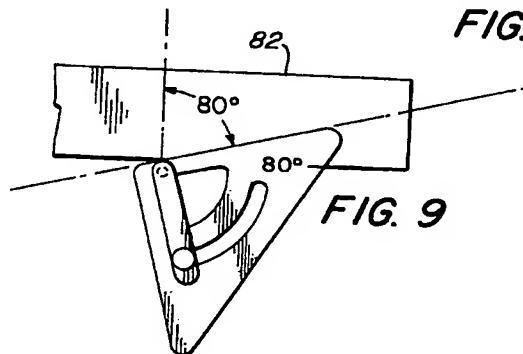
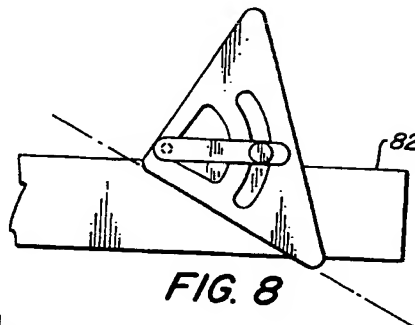
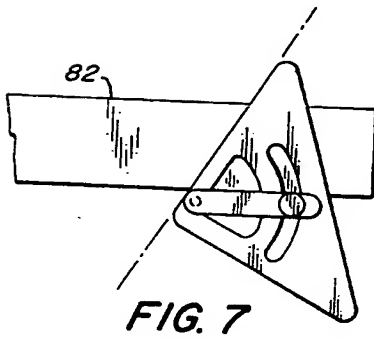
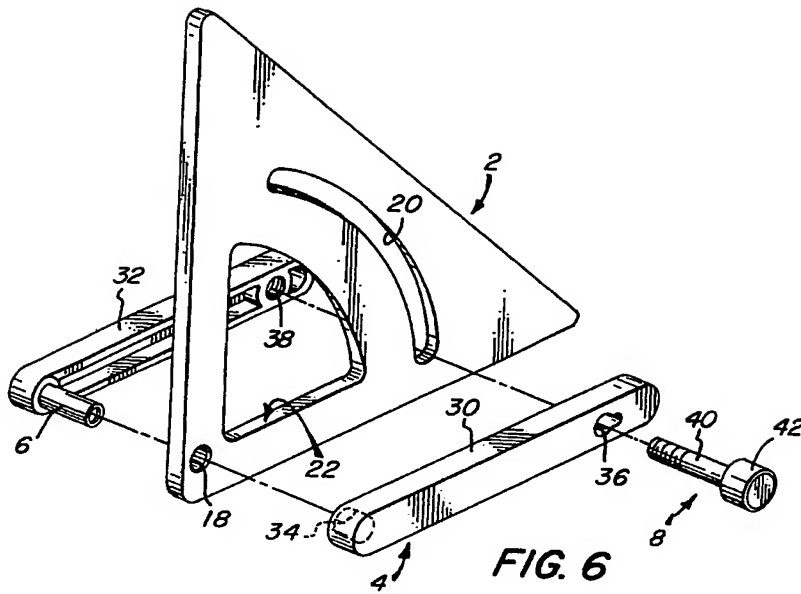


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## SPECIFICATION

## Square for use in laying out rafter cuts

- 5 The present invention relates to a square for use in laying out rafter cuts.

In framing of roofs, the ends of the rafters have to be cut at angles which vary with the pitch of the roof, i.e., the unit rise per unit length of the roof rafters, which is usually determined from the building plans. Moreover, the nature of the angular cuts will vary from those for a common pitched roof when the roof is a hip roof or has a valley.

- 15 Many framing squares have been devised which convert the unit rise per unit length of the roof rafters into angular relationships to facilitate the scribing of the angles for the two ends of the rafters. Some of these provide  
20 tables containing the data as indicia along the legs of the square, and the square is laid on the board to be cut by lining up the base point at one edge of the board and pivoting the square until the appropriate indicium on one leg is aligned with the other edge of the board. The scribe line is then drawn along that leg.

Other framing squares have used protractor configurations to lay out the angles. Some of  
30 these have been provided with conversion tables from the rise per length and others have provided this information at the appropriate position along the arcuate surface. Some have been provided with pivotable arms which  
35 may be swung to define the desired angular position and provide the linear edge along which the scribe line may be drawn.

According to the present invention there is provided a square for use in laying out rafter  
40 cuts comprising:

- a) an integrally formed body of right triangular configuration with first and second sides intersecting at a right angle and a third side extending between the opposite ends thereof,  
45 said body having a pivot aperture spaced along said second side from said point of intersection and inwardly from the second side, said body having a convexly arcuate slot therein spaced from the point of right angular intersection of said first and second sides and defined by a radius having said pivot aperture as its centre point, said arcuate slot extending from a point spaced more closely to said first side than said pivot aperture, said body also  
50 having an arcuate sided aperture therein between said arcuate slot and said arcuate sided aperture with its arcuate side adjacent said arcuate slot and a pair of rectilinear sides intersecting adjacent said pivot aperture, said arcuate side being defined by a radius having  
60 said pivot aperture as its centre point, said body having a first scale of angular graduation markings spaced along said arcuate side of said arcuate sided aperture, a second scale of  
65 graduation markings spaced along the side of

said arcuate slot adjacent said arcuate side, and a third scale of graduation markings spaced along the other side of said arcuate slot, the graduations of said second and third scales corresponding to the unit rise per length of run of the rafter to be marked, the second and third scales being graduated one for use with common rafter jacks and the other for use with jacks for hip and valley rafters;

- 70 b) a protractor arm comprising a pair of elongated arm elements extending along opposite surfaces of said body and overlying said pivot aperture and said arcuate slot;

80 c) pivot means engaged in said arm elements and extending through said pivot aperture; and

- d) slide lock means seated in said arm elements and slidable in said arcuate slot, said  
85 slide lock means being adapted for clampingly engaging said arm elements against the opposite surfaces of said body and being manipulatable to release the clamping engagement to permit movement of said protractor arm to a  
90 selected indicium of one of said second and third scales, whereby the longitudinal edge of said protractor arm adjacent said first side of said body may be placed against the upper edge of the rafter to be cut and said first side of said body provides the scribe line to be cut  
95 for a bottom cut, and whereby the other longitudinal edge of said protractor arm may be placed against the rafter to be cut and said second side of said body provides the scribe line to be cut for a top cut, and whereby said  
100 protractor arm may be used to define other angular cuts defined by said first side.

It is believed possible by means of the present invention to provide a novel roof framing square which is versatile and easy to use in laying out angular cuts for common roofs, hip roofs and valley roofs.

It is further believed possible by means of the present invention to provide such a roof framing square which enables the laying out and scribing of other desired angles and the measurement of some linear distances.

It is still further believed possible by means of the present invention to provide such a square which may be simply and relatively economically fabricated and which is rugged and durable in construction.

The invention will be described by way of example with reference to the accompanying drawings wherein:-

120 *Figure 1* is a plan view of the front surface of a rafter framing square embodying the invention;

*Figure 2* is a plan view of the rear surface thereof with a portion of the protractor arm broken away;

*Figure 3* is an edge elevational view thereof looking at the side edge as seen in Figs. 1 and 2;

130 *Figure 4* is an edge elevational view thereof

looking at the base edge as seen in Figs. 1 and 2;

Figure 5 is a fragmentary sectional view along the line 5-5 of Fig. 2;

5 Figure 6 is an exploded view thereof with the indicia omitted;

Figure 7 is a partially diagrammatic view showing the square being used for scribing a top cut on a rafter;

10 Figure 8 is a partially diagrammatic view showing the square being used for scribing a bottom cut on a rafter; and

Figure 9 is a partially diagrammatic view showing the square being used to scribe an angle on a workpiece.

15 Turning now in detail to Figs. 1-6 of the attached drawings, a rafter framing square embodying the present invention is comprised of an integrally formed body generally designated by the numeral 2 and having a right

20 triangular configuration, an elongated protractor arm generally designated by the numeral 4, pivot means 6 and slide lock means generally designated by the numeral 8.

25 The planar body 2 has its right triangular configuration defined by first side 10 and second side 12 which intersect at right angles at corner 14, and third, hypotenuse, side 16 which extends between the opposite ends

30 thereof. A pivot aperture 18 is spaced along the length of second side 12 from the first side 10, and inwardly from the edge of the second side 12. A convexly arcuate slot 20 is provided in the body 2 adjacent the third side

35 16 and is defined by a radius having the pivot aperture 18 as its centre point. The arcuate slot 20 extends from a point spaced more closely to the first side 10 than pivot aperture

40 18. Disposed between the pivot aperture 18 and the arcuate slot 20 is an arcuate sided aperture generally designated by the numeral 22 having its arcuate side 24 adjacent the

45 arcuate slot 20, and a pair of linear sides 26, 28 extending from the ends thereof and intersecting at a right angle adjacent the pivot aperture 18. The arcuate side 24 is defined by a radius having a pivot aperture 18 as its center point.

The protractor arm 4 is comprised of a pair

50 of elongated arm elements 30, 32 each of a thickness greater than the thickness of the body 2 and providing a planar outer surface. Adjacent the end thereof overlying the pivot aperture 18 is a recess 34 which is aligned

55 with and seats the pivot means or boss 6. Apertures 36, 38 therein are aligned with the arcuate slot 20 and seat the shank 40 of the threaded fastener comprising the slide lock means 8. As seen the fastener has an elongated knurled head 42 to facilitate manipulation. The aperture 38 in the arm element 32 is threaded to threadably engage the threaded end portion of the shank 40. The aperture 36 in the arm element 30 has a keyhole configuration to lock the shank 40 in its reduced

65

width portion. When the threaded fastener 8 is tightened, it draws the two arm elements 30, 32 tightly against the opposite surfaces of the body 2 to frictionally clamp the protractor arm 4 in a fixed position.

70 As seen in Figs. 1 and 2, the upper edge 44 of the protractor arm 4 extends across the arcuate sided aperture 22 above the linear side 26 and across the arcuate slot 20 above its lower end, and the lower edge 46 is therebelow. Its length is such that it extends beyond the slot 20, and is preferably such that it will at least extend to adjacent the third side 16 at the midpoint of its pivotal arc.

80 Disposed along the arcuate side 24 of the arcuate sided aperture 22 is a first scale generally designated by the numeral 48 of angular graduations 50 at 2° intervals commencing at a point tangent to the upper edge 44

85 of the protractor arm 4 when it extends parallel to the first side 10, and numeric values 52 from 0° to 70° in 10° increments. The linear graduations 50 are parallel to the edge 44 as the protractor arm 4 is swung along the

90 length of the arcuate side 24.

Disposed along the inner edge of the arcuate slot 20 is a second scale generally designated by the numeral 54 with linear graduations 55 tangent to the edge 44 of the protractor arm 4 and numeric values 56 commencing at 0 and initially at increments of 1 which increase to 4. Disposed along the outer edge of the arcuate slot 20 is a third scale generally designated by the numeral 58 with

100 linear graduations 60 and numeric values 62 initially in increments of 1 which increase to 6. These second and third scales 54 and 58 represent the numeric values of the unit rise per unit length of the run of rafter to be

105 marked, the second scale 54 being for the hip and valley rafter and the third scale 58 being for common or jack rafters.

In the illustrated embodiment, the unit of rise shown on the scales 54, 58 is in inches

110 (1 inch=2.54 cms) and the unit of length accordingly is in feet (1 foot=12 inches). The 0 mark or base line for laying out the graduations on the scales 54, 58 at the desired angular relationships is a line offset from the center of the pivot aperture 18 and parallel to the first side 10.

To determine  $\Delta C$  (the angular increment) from this 0° base position for the numeric indicia on the two scales, the following table

120 is employed:



	Unit Rise	Com/Jack	Hip/Valley
	1	4° 45' 49"	3° 22' 20"
5	2	9° 27' 44"	6° 43' 17"
	3	14° 2' 10"	10° 1' 30"
	4	18° 26' 5"	13° 15' 45"
	5	22° 37' 11"	16° 24' 59"
	6	26° 33' 54"	19° 28' 16"
10	7	26° 33' 54"	19° 28' 16"
	8	30° 15' 23"	22° 24' 54"
	9	36° 52' 11"	27° 56' 18"
	10	39° 48' 20"	30° 30' 32"
	11	42° 30' 37"	32° 57' 2"
15	12	45°	35° 15' 52"
	13	47° 17' 26"	37° 27' 12"
	14	49° 23' 55"	39° 39' 16"
	15	51° 20' 24"	41° 28' 22"
	16	53° 7' 48"	43° 18' 50"
20	17	54° 46' 56"	45° 2' 58"
	18	56° 18' 35"	46° 41' 10"
	20	59° 2' 10"	49° 41' 4"
	22	61° 23' 22"	52° 21' 13"
	24	63° 26' 5"	54° 44' 8"
25	26	65° 13' 29"	56° 51' 1"
	28	66° 48' 5"	58° 46' 49"
	30	68° 11' 55"	60° 30' 13"

Extending along the second side 12 in the rear face of the body 2 from a line corresponding to the 0° position of the protractor arm 4 is a fourth scale generally designated by the numeral 64. This scale 64 is a linear distance scale comprised of graduations 66 and numeric indicia 68, which in the illustrated embodiment are at inch increments. This allows the square to be used to make short measurements.

Along the third side 16 of the body 2 is a fifth scale generally designated by the numeral 70 cooperating with the first scale 48 as an extension thereof. It includes linear graduations 72 and numeric indicia 74, with a 0° mark at the 0° position of the protractor arm 4. The arc of the arcuate sided aperture 24 extends slightly more than 70° and the scale 48 is marked from 0° to 70°. The fifth scale 70 has indicia 74 and graduations 72 along the upper of the third side 16 to extend the protractor scale of angles to 90° at the intersection between the third and second sides 16, 12.

In framing a roof, the pitch is first determined in terms of rise per unit of length, e.g. inch rise per foot of length. The protractor arm 4 is then swung to locate its upper edge 44 tangent to the graduation on the appropriate scale 54, 58 corresponding to the unit rise. The slide lock screw 8 is tightened securely to lock the protractor arm 4 in this position.

For a bottom cut, i.e. the cut at the lower end of the intended rafter, the square is placed on the board 82 with the lower edge 46 of the protractor arm firmly seated against the upper edge of the board 82 as seen in

Fig. 8. A pencil (not shown) is then drawn along the first side 10 to define the line of cut across the board 82.

For a top cut, i.e. the cut at the upper end of the intended rafter, the square is placed on the board 82 with the upper edge 44 of the protractor arm 4 firmly seated against the lower edge of the board 82 as seen in Fig. 7. The scribe line for the cut is drawn along the second side 12.

It will be appreciated that the square can also be used to scribe lines for angular cuts by selecting the desired angle on the first scale and setting the protractor arm 4 to that edge. In Fig. 9, the use of the square to sink an 80° angle is depicted. The pivoted edge of the protractor arm 4 placed against the board 82 to be cut and the indicium 72 on the fifth scale 70 is aligned with the edge of the board 82. The scribe line is drawn along the side 12.

In using the square to scribe angles of 70° or less, the upper edge 44 of the protractor arm 4 is pivoted to the proper indicium on the scale 48. Depending upon the direction desired for the angular cut, the appropriate surface of the body 2 is disposed upwardly and the upper edge 44 of the protractor arm 4 placed against the workpiece and the line scribed along the edge 12.

The square and protractor arm may be fabricated from any durable, stable material such as aluminum, steel, brass, fiber reinforced synthetic resins such as polyamides, polyacetates, and polyphenylene oxides. Aluminum is preferred since it provides a good balance of strength, stability and light weight. The protractor arm elements can be die cast or machined from plate stock to provide a structure with cavities on the inner surface to reduce weight while providing a relatively thick edge surface to enable stable placement against the side surface of boards to be cut.

Thus, it can be seen that the rafter framing square above-described is versatile and easy to use for making various rafter cuts with a minimum of computation. It provides a simple but effective means for determining and scribing the angular cuts from a known rise per length data, and it also enables scribing cuts of desired angles for other purposes. It is simple to fabricate and rugged to provide a relatively long-lived assembly.

## CLAIMS

1. A square for use in laying out rafter cuts comprising:

a) an integrally formed body of right triangular configuration with first and second sides intersecting at a right angle and a third side extending between the opposite ends thereof, said body having a pivot aperture spaced along said second side from said point of intersection and inwardly from the second side, said body having a convexly arcuate slot

therein spaced from the point of right angular intersection of said first and second sides and defined by a radius having said pivot aperture as its centre point, said arcuate slot extending  
 5 from a point spaced more closely to said first side than said pivot aperture, said body also having an arcuate sided aperture therein between said arcuate slot and said arcuate sided  
 10 aperture with its arcuate side adjacent said arcuate slot and a pair of rectilinear sides intersecting adjacent said pivot aperture, said arcuate side being defined by a radius having said pivot aperture as its centre point, said  
 15 body having a first scale of angular graduation markings spaced along said arcuate side of said arcuate sided aperture, a second scale of graduation markings spaced along the side of  
 20 said arcuate slot adjacent said arcuate side, and a third scale of graduation markings spaced along the other side of said arcuate slot, the graduations of said second and third  
 25 scales corresponding to the unit rise per unit length of run of the rafter to be marked, the second and third scales being graduated one for use with common rafter jacks and the  
 other for use with jacks for hip and valley rafters;

b) a protractor arm comprising a pair of elongated arm elements extending along opposite  
 30 surfaces of said body and overlying said pivot aperture and said arcuate slot;

c) pivot means engaged in said arm elements and extending through said pivot aperture; and

d) slide lock means seated in said arm elements and slidable in said arcuate slot, said  
 35 slide lock means being adapted for clampingly engaging said arm elements against the opposite surfaces of said body and being manipulatable to release the clamping engagement to  
 40 permit movement of said protractor arm to a selected indicium of one of said second and third scales, whereby the longitudinal edge of said protractor arm adjacent said first side of  
 45 said body may be placed against the upper edge of the rafter to be cut and said first side of said body provides the scribe line to be cut for a bottom cut, and whereby the other longitudinal edge of said protractor arm may be  
 50 placed against the rafter to be cut and said second side of said body provides the scribe line to be cut for a top cut, and whereby said protractor arm may be used to define other angular cuts defined by said first side.

2. The square of claim 1 wherein said  
 55 body includes a fourth scale with unit length graduations spaced along said second side.

3. The square of claim 1 or 2 wherein said  
 60 clamping means includes a threaded recess in one of said arm elements and a threaded member seated in an aperture in the other of said arm elements.

4. The square of claim 3 wherein said  
 65 aperture in said other arm element has a key-hole configuration to lock said threaded mem-

ber therein.

5. The square of claim 4 wherein said  
 70 threaded fastener has an enlarged knurled head and a shank having a threaded portion engaged in said threaded recess.

6. The square of any preceding claim  
 75 wherein said arm elements are each of a thickness at least equal to that of said body member to provide a stable abutment surface for placement against the edge of a rafter.

7. The square of any preceding claim  
 80 wherein the zero graduation for each of said first, second and third scales is aligned with said other longitudinal edge of said protractor arm when it is parallel to said first side.

8. The square of any preceding claim  
 85 wherein said third side has a fifth scale along at least a portion of the length thereof comprising angular graduations cooperating with those of said first scale.

9. The square of claim 8 wherein said first  
 90 scale extends over an arc of less than 90° and said fifth scale includes indicia extending from the terminal indicia of said first scale to 90°.

10. A square substantially as described  
 with reference to and as illustrated in the accompanying drawings.

#### 95 CLAIMS

Amendments to the claims have been filed, and have the following effect:-

(b) New or textually amended claims have been filed as follows:-

100 1. A square for use in laying out rafter cuts comprising:

(a) an integrally formed body of right triangular configuration with the edges of first and second sides defining planes intersecting at a  
 105 right angle and defining a corner at the intersection thereof and a third side extending rectilinearly between the opposite ends thereof, said body having a pivot aperture spaced along said second side from said corner at the  
 110 intersection thereof and inwardly from the second side, said body having a convexly arcuate slot therein spaced from the said corner at the intersection of said first and second sides and defined by a radius having said pivot aperture  
 115 as its centre point, said arcuate slot extending from a point spaced more closely to said first side than the margin of said pivot aperture adjacent to said first side, said body also having an arcuate sided aperture therein spaced  
 120 between said arcuate slot and pivot aperture, said arcuate sided aperture having its arcuate side adjacent said arcuate slot and a pair of rectilinear sides with the planes of the edges thereof intersecting at a right angle at a point  
 125 adjacent said pivot aperture, said arcuate side of said arcuate sided aperture being defined by a radius having said pivot aperture as its centre point, each face of said body having a first scale of angular graduation markings  
 130 spaced along said arcuate side of said arcuate

sided aperture, a second scale of graduation markings spaced along the side of said arcuate slot adjacent said arcuate side, and a third scale of graduation markings spaced along the other side of said arcuate slot, the graduations of said second and third scales corresponding to the unit rise per unit length of run of the rafter to be marked, the second and third scales being graduated one for use with common rafter jacks and the other for use with jacks for hip and valley rafters;

(b) a protractor arm comprising a pair of elongated arm elements extending along opposite surfaces of said body and overlying said pivot aperture and said arcuate slot;

(c) pivot means engaged in said arm elements and extending through said pivot aperture; and

(d) slide lock means seated in said arm elements and slidable in said arcuate slot, said slide lock means being adapted for clampingly engaging said arm elements against the opposite surfaces of said body and being manipulatable to release the clamping engagement to permit movement of said protractor arm to a selected indicium of one of said second and third scales, whereby the longitudinal edge of either one of said arm elements of said protractor arm adjacent said first side of said body may be placed against the upper edge of the rafter to be cut and said first side of said body defines the scribe line to be cut for a bottom cut, and a scribing implement may be drawn therealong, and whereby the other longitudinal edge of either one of said arm elements of said protractor arm may be placed against the rafter to be cut and said second side of said body defines the scribe line to be cut for a top cut and a scribing implement may be drawn therealong, and whereby said protractor arm may be used to define other angular cuts defined by said first side.

3. The square of claim 1 or 2 wherein said slide lock means includes a threaded recess in one of said arm elements and a threaded member seated in an aperture in the other of said arm elements.

4. The square of claim 3 wherein said aperture in said other arm element has a key-hole configuration to seat said threaded member therein.

5. The square of claim 4 wherein said threaded member has an enlarged knurled head and a shank having a threaded portion engaged in said threaded recess.

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